

**REMARKS**

Reconsideration of the present claims, in light of the attached claim amendments and the Remarks which follow, is respectfully requested.

Claims now before the Examiner are 1, 6, 13, 17-20, 30, 33-42 and new claims 43-100. Claims 22-27, 38 have been withdrawn from consideration.

The numbering in this response will follow that of the Examiner's Action.

1. No response necessary.
2. Applicant thanks the Examiner for the withdrawal of the bulk of the prior art.
3. Claims 1, 6, 13, 17-20, 30 and 33-42 have been rejected under 35 USC § 112. Applicant has made the requested style amendments.

**Rejections Under 35 USC § 102 and 35 USC § 103**

4. No response necessary.
5. Claims 1, 6, 13, 17-20, 30, and 33-42 have been rejected under 35 U.S.C. § 102(e) as anticipated by or in the alternative 35 USC § 103(a) as obvious over US 5,866,663 (Brookhardt).

Brookhardt at Column 51, 50-column 52, line 13, discloses the use of heterogeneous inorganic materials, such as surface hydrated silica, are non-coordinating counterions as activators for the catalyst compounds, not as supports for activators, activated catalyst compounds or the catalyst compounds themselves. In the examples Brookhardt discloses a palladium catalyst activated with  $\text{SbF}_6^-$  (a group 15 halide salt) alone and the same activated catalyst combined with silica (at a level of about 126  $\mu\text{m}$  transition metal per gram of silica) for ethylene polymerization. During the preparation of the catalyst/silica combination, it is unclear how much solvent remained in the catalyst system from the text of Example 98. A comparison of the examples is presented in Table A.

Table A

Example	Catalyst	Mw	Mn	Mw/Mn	Yield
97	no silica	347,000	149,000	1.33	28.2g
98	silica present	118,000	6,900	17.08	7.95g

Note that the catalyst/silica combination produced a "gummy" lower molecular weight polymer with a broader molecular weight distribution compared to the non-tacky rubbery polymer of example 97. Further please note that the system with the silica had much lower activity. Thus the lessons from Brookhardt are that the silica system impairs polymer properties and causes a much lower catalyst activity.

When comparing Brookhardt to the claims we must conclude that:

- a) with regard to claim 1, nothing within the four corners of Brookhardt specifically discloses Applicant's supported catalyst system where the catalyst compound and the activator are present on an inactive support and the transition metal loading is 100  $\mu\text{m}$  or less. Thus claim 1, and all the claims dependent thereon, are not anticipated by Brookhardt under 35 USC § 102(e);
- b) with regard to claim 6, nothing within the four corners of Brookhardt specifically discloses Applicant's supported catalyst system where the catalyst compound and the activator, which is not a group 15 halide salt, are present on an inactive support. Thus claim 6, and all the claims dependent thereon, are not anticipated by Brookhardt under 35 USC § 102(e); and
- c) with regard to claim 13, nothing within the four corners of Brookhardt specifically discloses Applicant's supported catalyst system where the catalyst compound and the activator are present on an inactive support, the transition metal loading is 100  $\mu\text{m}$  or less and which is essentially without residual solvent. Thus claim 13, and all the claims dependent thereon, are not anticipated by Brookhardt under 35 USC § 102(c).

The Examiner also suggests that the claimed invention is obvious over Brookhardt. Applicant respectfully disagrees. Brookhardt discloses various di-imine catalyst compounds that can be activated to polymerize ethylene. Brookhardt mentions certain inorganic materials, such as surface hydrated silica, can be used as activators and provides an example of an activated palladium catalyst combined with silica that polymerizes ethylene poorly. It is unclear from the text of the example

whether or not the activated catalyst is immobilized upon the support. The presence of solvent in the system, such as methylene chloride or hexane, in higher quantities would wash the activated catalyst away from the silica such that a solution polymerization would be occurring in the presence of silica. Thus it is fair to conclude that example 98 might or might not disclose an immobilized catalyst. In either event, however, the system is disclosed to be significantly inferior to the silica free system of example 97. Thus, Brookhardt, when read fairly in its entirety, does not teach that Applicant's supported catalyst systems which produce high molecular weight, narrow molecular weight distribution polymers, particularly polymers that can be used in film applications because they have densities in the range of 0.91 g/cc. Brookhardt's polymer was "gummy." That does not make a good film. Further, the comparative data presented in the examples section of the instant application clearly show unexpected results are obtained using Applicant's claimed system versus using the system of example 98. Therefore, since nothing within Brookhardt discloses Applicant's claimed supported catalyst systems and nothing within Brookhardt presents a reasonable expectation that Applicant's supported catalyst system can successfully produce film grade polymers, Applicant respectfully submits that the claimed invention is not obvious over Brookhardt under 35 USC § 103(a).

Claims 1, 6, 13, 17-20, 30, and 33-42 have been rejected under 35 U.S.C. § 103(a) as obvious over any of U.S. 4,849,542 (Drent) or J. Am. Chem. Soc., Vol 117, No. 23, PP. 6414-6415, (1995) (Johnson), in view of US 5,866,663 (Brookhardt).

Drent is directed to acid and/or ester synthesis using mineral acids. Drent does not disclose a catalyst system capable of olefin polymerization. Drent also does not disclose supported catalyst systems. Absolutely nothing within the four corners of Drent discloses or suggests Applicant's claimed invention. Further the combination of Drent with Brookhardt does not produce a viable coordination polymerization catalyst system. Adding silica to Drent's catalyst system will not change the mineral acids into olefin polymerization catalysts. Thus no one of ordinary skill in the art would look to Drent for guidance on coordination polymerization catalyst systems. It is only with the advantage of hindsight reconstruction using Applicant's claims as a map, that one of ordinary skill in the art would not think to combine Drent with Brookhardt. Applicant respectfully submits that the claimed invention is not obvious over Drent in view of Brookhardt under 35 USC § 103(a).

Johnson discloses di-imine catalysts used in solution polymerization to produce ethylene polymers and, as the Examiner acknowledges, does not disclose supports. Brookhardt discloses an example where a silica/activated catalyst combination produced a gummy, rubbery lower molecular weight ethylene polymer with a broad molecular weight distribution. Combining these two references

does not produce Applicant's claimed invention of a supported catalyst system that produces higher molecular weight polymers with narrow molecular weight distributions and, film grade densities in some embodiments. Likewise the combination of Johnson and Brookhardt does not present a reasonable expectation of successfully obtaining useful higher molecular weight narrow molecular weight distribution polymers from Applicant's particular combination. Applicant respectfully submits that the claimed invention is not obvious over Johnson in view of Brookhardt under 35 USC § 103(a).

In summary, Applicant submits that any analysis of obviousness of a claimed combination must include consideration of the results achieved by that combination. When the prior art does not suggest that the components be combined as they were by the inventor or that such combination could achieve the advantages found by the inventor, the claimed invention is not obvious over that prior art. Applicant has shown that none of the references alone or in combination suggest that the catalyst, support and activator be combined as they were by Applicant to achieve the superior polymers.

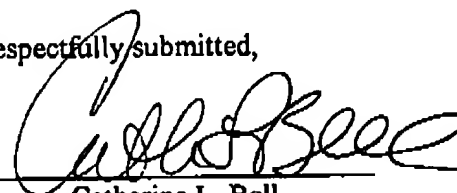
Applicant respectfully submits that the claimed invention is neither anticipated nor obvious over the references cited and respectfully request the rejections be withdrawn.

Applicant believes the claims are in condition for allowance and respectfully requests notice of such.

June 6, 2003

Date

Respectfully submitted,



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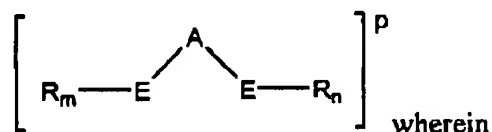
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# MARKED UP CLAIMS

- I. (Amended SIX Times) A [late] transition metal catalyst system for olefin polymerization comprising: I.) a Group-9, -10 or -11 metal connected to a bidentate ligand [, wherein catalyst precursor has the] represented by the formula:

LMX<sub>r</sub>, wherein:

- (a) M is a Group 9, 10 or 11 metal;  
 (b) L is a bidentate ligand defined by the formula:



- (i) A is a bridging group containing a Group 13-15 element;  
 (ii) each E is independently a Group 15 or 16 element covalently bonded to M;  
 (iii) each R is independently a C<sub>1</sub>-C<sub>30</sub> radical or diradical group which is a hydrocarbyl, substituted hydrocarbyl, halocarbyl, substituted halocarbyl, hydrocarbyl-substituted organometalloid, or halocarbyl-substituted organometalloid[,];  
 (iv) m and n are independently 1 or 2 [depending on the valency of E];  
 and  
 (v) p is the charge on the bidentate ligand such that the overall charge of LMX<sub>r</sub> is neutral;  
 (c) each X is, independently, a hydride radical, a hydrocarbyl radical, a substituted hydrocarbyl radical, a halocarbyl radical, a substituted halocarbyl radical, hydrocarbyl-substituted organometalloid or halocarbyl-substituted organometalloid; a univalent anionic ligand; a neutral hydrocarbyl-containing donor ligand; a neutral non-hydrocarbyl atom containing donor ligand; or two Xs are joined and bound to the metal atom to form a metallacyclic ring containing from 2 to 20 carbon atoms; or two Xs are joined to form an anionic chelating ligand; and  
 (d) r is 1, 2 or 3;

- II.) an activator compound; and

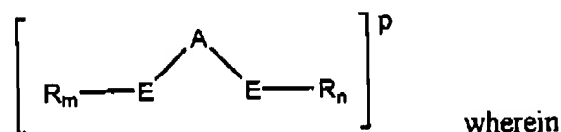
III.) a solid support wherein said [late] transition metal connected to said bidentate ligand is immobilized on said support, where the [late] transition metal loading is less than 100 micromoles transition metal per gram of solid support.

6. (Amended SIX Times) A [late] transition metal catalyst system for olefin polymerization comprising:

I) a Group -9, -10 or -11 metal connected to a bidentate ligand, [wherein a catalyst precursor has] represented by the formula:

LMX<sub>p</sub>, wherein:

- (a) M is a Group 9, 10 or 11 metal;
- (b) L is a bidentate ligand defined by the formula:



- (i) A is a bridging group containing a Group 13-15 element;
- (ii) each E is independently a Group 15 or 16 element covalently bonded to M;
- (iii) each R is independently a C<sub>1</sub>-C<sub>30</sub> radical or diradical group which is a hydrocarbyl, substituted hydrocarbyl, halocarbyl, substituted halocarbyl, hydrocarbyl-substituted organometalloid, or halocarbyl-substituted organometalloid[.];
- (iv) m and n are independently 1 or 2 [depending on the valency of E]; and
- (v) p is the charge on the bidentate ligand such that the charge of LMX<sub>p</sub> is neutral;
- (c) each X is, independently, a hydride radical, a hydrocarbyl radical, a substituted hydrocarbyl radical, a halocarbyl radical, a substituted halocarbyl radical, hydrocarbyl-substituted organometalloid or halocarbyl-substituted organometalloid; a univalent anionic ligand; a neutral hydrocarbyl-containing donor ligand; a neutral non-hydrocarbyl atom containing donor ligand; or two Xs are joined and bound to the metal atom to form a metallacycle ring

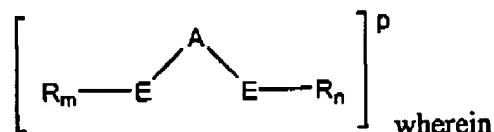
containing from about 2 to about 20 carbon atoms; or two Xs are joined to form an anionic chelating ligand; and

- (d)  $r$  is 1, 2 or 3;
- II) an activator compound, provided that the activator is not a Group 15 halide salt; and
- III.) a solid support wherein said [late] transition metal connected to said bidentate ligand is immobilized on said support.

13. (Amended Five Times) A [late] transition metal catalyst, essentially without residual solvent, for olefin polymerization comprising: I.) a Group -9, -10 or -11 metal connected to a bidentate ligand, [wherein a catalyst precursor has] represented by the formula:

LMX, wherein:

- (a) M is a Group 9, 10 or 11 metal;
- (b) L is a bidentate ligand defined by the formula:



- (i) A is a bridging group containing a Group 13-15 element;
- (ii) each E is independently a Group 15 or 16 element covalently bonded to M;
- (iii) each R is independently a  $\text{C}_1$ - $\text{C}_{30}$  radical or diradical group which is a hydrocarbyl, substituted hydrocarbyl, halocarbyl, substituted halocarbyl, hydrocarbyl-substituted organometalloid, or halocarbyl-substituted organometalloid[.];
- (iv)  $m$  and  $n$  are independently 1 or 2 [depending on the valency of E]; and
- (v)  $p$  is the charge on the bidentate ligand such that the [oxidation state of MX, is satisfied] overall charge of LMXr is neutral;
- (c) each X is, independently, a hydride radical, a hydrocarbyl radical, a substituted hydrocarbyl radical, a halocarbyl radical, a substituted halocarbyl radical, hydrocarbyl-substituted organometalloid or halocarbyl-substituted organometalloid; a neutral hydrocarbyl-containing donor ligand; a univalent

## CLAIMS MARKED-UP TO SHOW CHANGES MADE

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anionic ligand; a neutral non-hydrocarbyl atom containing donor ligand; or two Xs are joined and bound to the metal atom to form a metallacyclic ring containing from about 2 to about 20 carbon atoms; or two Xs are joined to form an anionic chelating ligand; and

(d) r is 1, 2 or 3;

II.) an activator compound; and

III.) a solid support wherein said [late] transition metal connected to said bidentate ligand is immobilized on said support, where the [late] transition metal loading is less than 100 micromoles transition metal per gram of solid support.

17. (Amended FIVE times) [A] The catalyst system [wherein the catalyst precursor] of Claims 1, 6, or 13 wherein said activator comprises [is one of] an alkylalumoxane, a modified alkylalumoxane, an aluminum alkyl, an aluminum alkyl halide, an aluminum halide, an ionizing anion precursor compound and or a noncoordinating anion precursor.
18. (Amended Once) The catalyst system of Claim 17 wherein the noncoordinating anion precursor comprises tetrakis(perfluorophenyl)boron.
19. (Amended Four Times) The catalyst system of claim 1 or 13 wherein the activator [the noncoordinating anion precursor] comprises [is] a halide salt of Group-13-16 metals or metalloids.
20. (Three Times Amended) The catalyst system of Claim [19] 18 wherein the catalyst-precursor-to-noncoordinating-anion-precursor molar ratio is from 10:1 to 1:10.
33. The catalyst system of Claim 17 wherein the [particle] support comprises silica.
35. The catalyst system of Claim 17 wherein the metal M of the catalyst precursor is a first row transition metal [metal complex is a first row metal complex].
36. (Amended Once) The catalyst system of Claim 17 wherein the [bidentate ligand structure comprises a bridging element and wherein the bridging element has at least one



## CLAIMS MARKED-UP TO SHOW CHANGES MADE

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conjugated group] bridging group A of the bidentate ligand comprises at least one conjugated group.

39. (Once Amended) The catalyst of Claim [38] 17 wherein the catalyst-precursor-to-alumoxane molar ratio is from 1:500 to 10:1.
40. (Amended Once) The catalyst system of claim 17 wherein [the metal of the metal cation] M is Ni.

Please add the following new claims:

41. (New) The catalyst system of Claim 17, wherein said alkylalumoxane comprises methylalumoxane, or wherein said modified alkylalumoxane comprises modified methylalumoxane.
42. (New) The catalyst system of claim 19, wherein a total transition metal compound to noncoordinating anion precursor mole ratio is from 10:1 to 1:10.